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United States
Department of
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Forest Service

**Forest Pest
Management**

**Methods
Application
Group**

Fort Collins,
Colorado 80524

Report MAG 94-1

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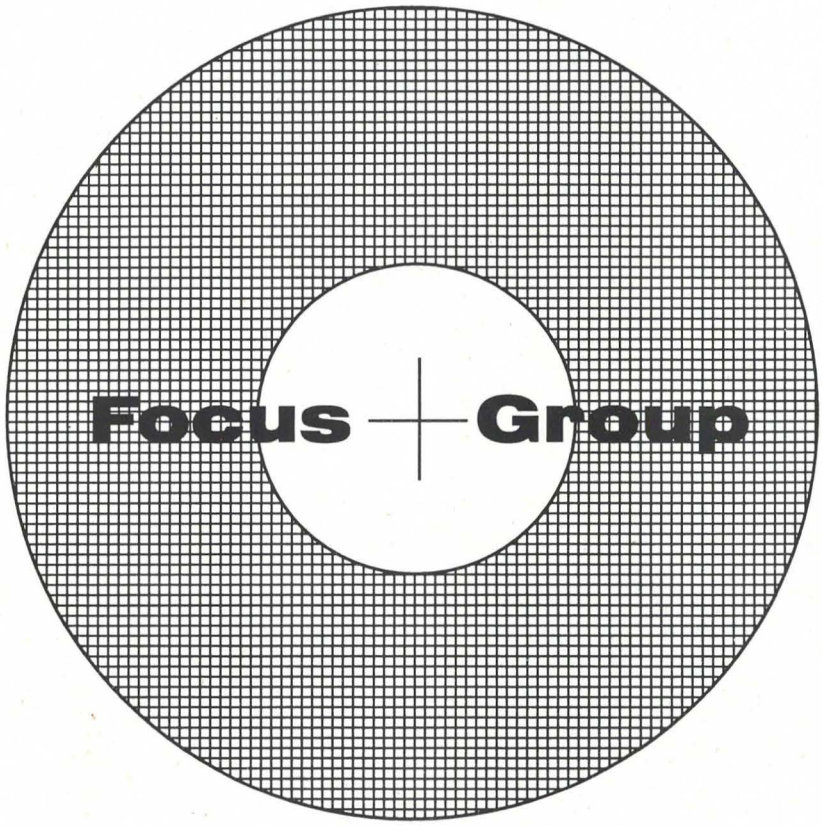
Forest Health Technology 2000

Forest Health Challenges



Summary and Recommendations

Overview

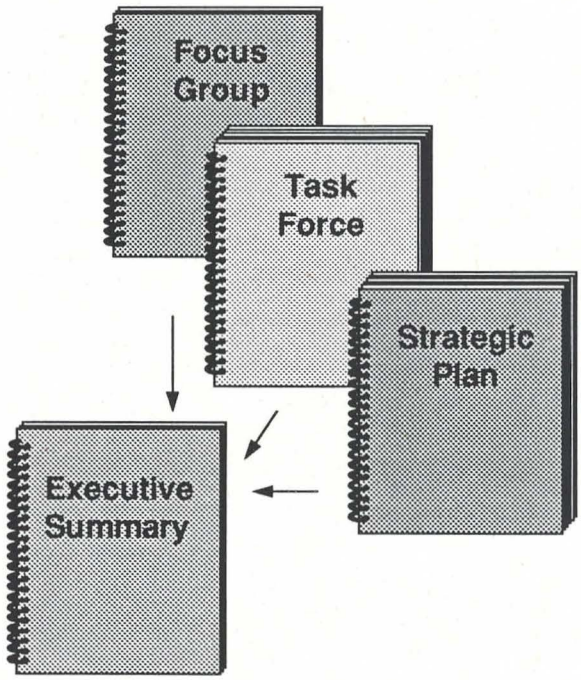
Forest Health Technology 2000 is a strategic planning process. The goal of the process is to identify challenges to forest health in the 21st Century and to ensure the availability of appropriate ecosystem management technologies to help meet those challenges. There are three principal components of this process:

The **National Forest Health Challenges Focus Group** identified six major forest health challenges, and suggested emerging technologies appropriate to address those challenges;

The **Forest Health Technology Task Force** developed more detailed concept plans for the adaptation, development, testing, and implementation of technological systems appropriate to five of the identified challenge areas; and

The **Methods Applications Group Strategic Plan** presents a more refined strategic plan for the accomplishment of those technology development and implementation activities suited to the mission and capabilities of FPM/MAG and its contractors and cooperators.

The results of Forest Health Technology 2000 are documented in three coordinated reports (cited herein) and are summarized in the *Forest Health Technology 2000 Executive Summary*.



FOREST HEALTH TECHNOLOGY 2000

SUMMARY AND RECOMMENDATIONS OF THE NATIONAL FOREST HEALTH CHALLENGES FOCUS GROUP

January 26, 1994

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Ecosystem management means using an ecological approach to achieve the multiple-use management of national forests and grasslands by blending the needs of people and environmental values in such a way that national forests and grasslands represent diverse, healthy, productive, and sustainable ecosystems.

Charter for Ecosystems Management
USDA Forest Service

No later than September 30, 1997, the head of each agency shall submit to the Director of the Office of Management and Budget and to the Congress a strategic plan for program activities.

Government Performance and Results Act of 1993
Public Law 103-62 -- August 3, 1993
306. Strategic Plans

SUMMARY AND RECOMMENDATIONS OF THE NATIONAL FOREST HEALTH CHALLENGES FOCUS GROUP

The USDA Forest Service initiated ***Forest Health Technology 2000*** to identify emerging challenges to forest health and to develop a strategy for making available appropriate technology for meeting those challenges. To guide this national program, the **Forest Health Challenges Focus Group** was formed. The charge to the Group was to identify and define critical forest health and forest ecosystem management issues for the twenty-first century, and to help articulate a relevant technology development and implementation strategy.

The Focus Group members were given great latitude in defining the scope and method for accomplishing their mission, but they were specifically asked to identify:

- major forest health and ecosystem management issues;
- advancing technologies appropriate to forest health management;
- needs for improved forest user-manager interactions; and
- forest health management technology priorities.

In addition, the Focus Group will provide guidance and review progress of a Technology Development Task Force charged with the detailed tactical planning for the adaptation, development, and implementation of identified forest health and ecosystem management technologies.

The **Forest Health Challenges Focus Group** is composed of a diverse blend of scientists, educators, resource managers, policy makers, and technologists. The range of expertise and the breadth of experience represented uniquely qualifies the Group to guide the development of an appropriate technological base to help meet the forest health and ecosystem management challenges of the coming century.

Forest ecosystem management should not be directed by technology. We must focus first on long-term management needs. ***Then*** *we can look for technologies that can help meet those needs.*

Forest Health Challenges Focus Group
(November 30, 1993)

The *Forest Health Challenges Focus Group* was convened by the USDA Forest Service in Las Vegas, Nevada, on November 30 and December 1, 1993. The meeting was coordinated by the Resource Technology Institute with professional facilitation and recording provided by Lockheed Environmental Systems & Technologies Company, Las Vegas, Nevada.

All members of the Group received general background materials prior to the meeting, including: 1) a brief description of the USDA Forest Service and the recently adopted *Mission, Vision and Guiding Principles* statement; 2) a description of the relationships within the agency among State and Private Forestry, Forest Pest Management, and the Methods Applications Group technology development programs; and 3) the basic goals of **Forest Health Technology 2000**, including the role of the National Focus Group.

The meeting was opened by Mel Weiss, Director of Forest Pest Management, who reviewed the goals of the Forest Health Technology 2000 program, and presented the general charge to the group. Additional background information was provided by the program staff and by members of the Focus Group.

The two days of discussions were designed to capture Focus Group thinking regarding significant challenges facing forest health and ecosystem management in the year 2000 and beyond, and the types of technology applications that might be used to successfully meet those challenges. Six major ***Challenge/Technology*** categories emerged from the discussions: *data/information needs*, *analysis and model projections*, *information display*, *decision support*, *value determination*, and *management action alternatives*. Each of the categories is summarized below.

DATA/INFORMATION NEEDS

Challenge--Quality data spawns quality information and is the foundation for credible decision making. Ecosystem management will require unprecedented volumes of data and information at unprecedented levels of temporal and spatial resolution. Open access to large, widely distributed data bases will create numerous new concerns.

- How do we provide expanded access to data bases and still insure adequate levels of confidentiality, security, quality, and appropriateness of use?
- How do we cope with a vastly expanded data stream?
- How do we effectively use the real-time data stream to monitor changing conditions and to quickly detect departures from planned progress toward desired future conditions?
- How do we better access the ever-growing volume of archived data?
- How do we integrate disparate data to obtain needed information?
  - There are wide variances in spatial and temporal resolution.
  - Historical and contemporary databases are rarely consistent.
  - Measurement methods and standards vary with place and time.
- How do we identify and document the sources of derived variables (i.e., slope, diversity, edge)?

Technology--Currently available or readily adaptable data collection, storage, and management technologies can greatly improve our ability to capture, archive, and access many different forms of data from widely distributed sources. Some of the technologies that can help ensure that the right information gets to the right place at the right time include:

- Satellite systems with increasing spectral, temporal, and spatial resolution
- Enhanced airborne videography (IR sensors, multi-band scanners, CCD digital framing cameras)
- Ground-based automated monitoring systems (weather stations, stream gages, atmospheric samplers)
- Portable self-documenting field data collection devices (pen-based systems, bar-code scanners, voice recognition)
- Precise and reliable geo-referencing (GPS, orthophoto, and DEM registration)
- On-line, real-time data sampling and filtering systems
- Archive search and retrieval systems (computer networks, "know-bots," sub-pixel analysis, intelligent spatial and temporal gap-filling algorithms)
- GIS (standardized formats, open architectures, customized applications software)

ANALYSIS AND MODEL PROJECTIONS

Challenge--Prediction models form the core of ecosystem decision support. The quality of models is limited by the state of scientific knowledge, but ecosystem management decisions must be made now. What is needed are analytical tools that capitalize on the best available science, while indicating new research needs.

- How do we build on existing stand-based, single-pest models to better represent multi-faceted, landscape-scale ecosystem processes?
- How can we better assess and display the magnitude of error as it propagates through a complex analytical system?
- How can we better represent the effects of stochastic perturbations and disturbance events (fire, insects, disease)?
- What can be done to boost the credibility of our model-based projections with the public?

Technology--Existing tools can assist in the development, expansion, and incorporation of existing models into more powerful systems for investigating ecosystem processes. The migration path toward new systems must be based on realistic assumptions about advancing technological capabilities and must achieve adequate "comfort levels" among scientists, managers, policy makers, and the public. Potential tools and approaches include:

- Adaptive management procedures that facilitate model verification and correction and direct decision-relevant research
- New programming languages and system architectures that take better advantage of hardware capabilities
- Process-based modeling approaches that better represent temporal and spatial dynamics and account for stochastic events

INFORMATION DISPLAY

Challenge--Effective displays of projected ecosystem conditions are essential to public understanding of and support for management actions. More and more, managers will be required to communicate meaningfully with diverse publics in order to achieve consensus in choosing among the wide array of complex possible futures, each having variable levels of uncertainty.

- How do we expand public access to the ecosystem management process?
- How do we deal effectively with the consequences of greatly expanded accessibility requirements (e.g., report generation, data security and confidentiality, cost control)?
- How do we effectively translate quantitative projections of complex outcomes that have spatial and temporal uncertainty?

Technology--Information-highway technologies can be combined with advances in data visualization and environmental simulation systems to support meaningful interactions with a nationally distributed audience.

- The information highway will expand access (technological challenges include overcoming near-term bandwidth and distribution system limitations)
- CD-ROM and interactive, high-definition television extend opportunities for public interaction
- Interactive games and simulation systems (e.g., Sim-City, Sim-Earth) provide new means for communication

DECISION SUPPORT

Challenges--Public land managers must make complex decisions in a "fish-bowl" environment in strict compliance with a complex system of policies, laws, and regulations that often conflict. Ecosystem management requires the ability to assemble unprecedented quantities of textual, tabular, and geographic data needed to drive suites of interrelated biophysical and socioeconomic models. The projections of these complex systems must be comprehended by multi-disciplinary planning teams and accepted by concerned constituencies.

- How do we efficiently and effectively extract, organize, and display the enormous quantities of information required for ecosystem management decisions?
- How do we more effectively document and archive the ecosystem management decision-making process, including the values, goals, and constraints in effect at the time?
- How do we make decisions more robust and responsive to uncontrolled changes in environmental conditions and to changing public values?

Technology--Decision support systems organize and integrate data, guide analyses, generate reports and track and document the decision-making process. Advances in decision support tools promise to facilitate the complex tasks of ecosystem management. Available and emerging tools include:

- Effective and well-supported CASE tools and tool boxes
- Relational and object-oriented data bases that are linked by geographic and temporal references
- Interactive 3-D and 4-D display tools
- Problem-oriented, self-documenting systems
- Automated data and information search, retrieval, and conversion tools

VALUE DETERMINATION

Challenge--The forest planning process must be value driven. Ecosystem management implies new non-traditional values for forest planning, including *sustainability*, *robustness*, *resiliency*, *biodiversity*, and *ecosystem health*.

- How do we identify relevant public values?
  - Values are not static, they are dynamic.
  - Agencies may have conflicting values.
  - Public expectations may not match agency capabilities.
- How do we translate those values into measurable indicators?
- How do we prepare land managers and the public for the value trade-offs that must be made in the future?

Technology--Emerging communications technology can facilitate the process of interacting with the public to identify and articulate ecosystem values. Such technologies include:

- Communications (e.g, electronic polling, electronic town halls, E-mail)
- Multimedia (e.g., CD ROM)
- Interactive television (e.g., public access to agency information networks, simulation games)

MANAGEMENT ACTION ALTERNATIVES

Challenge--An ecosystem focus forces public land management into uncharted territory; non-traditional problems may require unconventional management responses. There is little or no history of the management of complex environmental processes that interact spatially over an entire landscape for time periods that extend over many human generations.

- How do we prepare managers and develop management systems to address the broadening scope of responsibilities?
- How do we expand the array of action alternatives to provide managers with a tool kit better suited to ecosystem management objectives?
- How do we better anticipate future problems and opportunities that will arise as the ecosystem management process matures?

Technology--Biotechnology and controlled applications of ecological change agents show great promise, but they have yet to be fully developed and tested. In addition, unconventional combinations and scheduling of traditional management actions may prove effective. Some possibilities include:

- Biological pest control (pheremones, natural enemies)
- Expanded use of prescribed fire and controlled burning
- More ecologically sensitive silvicultural treatments and schedules

IT01 ***PROVIDE CLEAR, STRONG LEADERSHIP TO INTEGRATE INFORMATION TECHNOLOGY INTO THE BUSINESS OF GOVERNMENT****

RECOMMENDATIONS

The primary goal of Forest Health Technology 2000 is to identify emerging forest health challenges for the 21st Century, and to develop a strategy for making appropriate technology available to meet those challenges. The national ***Forest Health Challenges Focus Group*** has identified six major technology development areas that should be addressed. While all of these areas are interrelated, each presents some unique problems and requires specialized types of knowledge and expertise.

It is recommended that the Forest Health Technology Task Force develop individual plans within each of the identified areas, but that careful attention be given to the coordination of efforts in each area. A consolidated development and implementation plan should be prepared and presented to the Focus Group for review. The plan should include detailed budgets, time tables and personnel assignments required for the development, testing and timely delivery of technological systems that address the six Challenge areas identified by the Focus Group. All plans should respond to the Forest Health Strategic Plan and be consistent with the *Mission, Vision and Guiding Principles* of the Forest Service.

IT03 ***DEVELOP INTEGRATED ELECTRONIC ACCESS TO GOVERNMENT INFORMATION AND SERVICE****

*Recommendations from:
Creating a Government that Works Better and Costs Less: Report of the National Performance Review.
Vice President Al Gore (September 10, 1993)

Forest Health Challenges Focus Group

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